Spatial Variations in Vitreous Oxygen Consumption.

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Public Summary:
In this study, we investigated the spatial variation of vitreous oxygen consumption in enucleated porcine eyes. We fabricated a custom oxygen source, implanted it in the mid vitreous and the posterior vitreous and found that the oxygen concentration profiles were statistically different between these two locations; suggesting a spatial variation in vitreous oxygen consumption. In conjunction with that finding, we observed statistically different concentrations of ascorbate across the two locations and quantified the reaction rate between ascorbate and oxygen invitreous

Scientific Abstract:
We investigated the spatial variation of vitreous oxygen consumption in enucleated porcine eyes. A custom made oxygen source was fabricated that could be localized to either the mid or posterior vitreous cavity and steady state vitreous oxygen tension was measured as a function of distance from the source using a commercially available probe. The reaction rate constant of ascorbate oxidation was estimated ex vivo by measuring the change in oxygen tension over time using vitreous harvested from porcine eyes. Vitreous ascorbate from mid and posterior vitreous was measured spectrophotometrically. When the oxygen source was placed in either the mid-vitreous (N = 6) or the posterior vitreous (N = 6), we measured a statistically significant decrease in vitreous oxygen tension as a function of distance from the oxygen source when compared to control experiments without an oxygen source; ($p<0.005$ for mid-vitreous and $p<0.018$ for posterior vitreous at all distances). The mid-vitreous oxygen tension change was significantly different from the posterior vitreous oxygen tension change at 2 and 3mm distances from the respective oxygen source ($p<0.001$). We also found a statistically significant lower concentration of ascorbate in the mid-vitreous as compared to posterior vitreous ($p = 0.02$). We determined the reaction rate constant, k = 1.61 M-1s-1 +/- 0.708 M-1s-1 (SE), of the oxidation of ascorbate which was modeled following a second order rate equation. Our data demonstrates that vitreous oxygen consumption is higher in the posterior vitreous compared to the mid-vitreous. We also show spatial variations in vitreous ascorbate concentration.